

Two Species of Chloroperlidae (Insecta: Plecoptera) New to Korea, with Adult Keys to Species of the Family in Korea

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ABSTRACT

Two species of the chloroperlid stonefly, *Alloperla mediata* and *Sweltsa illiesi*, are reported for the first time in Korea. *Alloperla mediata* can be distinguished by the smaller epiproct and the presence of a median sclerite under epiproct in male, and by the modified subgenital plate in female. *Sweltsa illiesi* can be distinguished by the presence of a pair of ridges on tergum 9 in male and upward V-shaped pattern on the center of head in adults. The line drawings of diagnostic characters and taxonomic remarks of the two species are provided with keys and comparative characters for adults of Korean Chloroperlidae.

Key words: *Alloperla mediata*, *Sweltsa illiesi*, Chloroperlidae, Plecoptera, Insecta, Korea

INTRODUCTION

Chloroperlidae includes more than 200 species mainly in the Holarctic region. The genera *Alloperla*, *Sweltsa*, and *Triznaka* have Nearctic and Eastern Palearctic distribution including almost 80 species. Especially in Europe 19 species in four genera are present (Fochetti and Tierno, 2008). North America includes 98 species in 13 genera (Stark et al., 2008). And Asia contains 89 species in five genera (Fochetti and Tierno, 2008).

North Korean Plecoptera includes 23 species in nine families and among them Chloroperlidae contains two valid species of the genus *Alloperla* and an unnamed species of the genus *Triznaka* (Zhiltzova and Zwick, 1971; Kim et al., 1993). Zhiltzova and Zwick (1971) reported two valid species, *Alloperla rostellata* and *Alloperla picta* and the female of *Triznaka* sp. from North Korea.

Korean Plecoptera includes 40 species in 10 families and among them Chloroperlidae contains four valid species in three genera (*Alloperla*, *Sweltsa*, and *Haploperla*): two species of the genus *Alloperla* (*A. joosti* and *A. rostellata*), two species of the genus *Sweltsa* (*S. lepnevae* and *S. nikkoensis*), and an unnamed species of the genus *Haploperla* (Yoon and Aw, 1985; Cho, 1991; Kim et al., 1998). Among the above Korean chloroperlid species, *Sweltsa nikkoensis* was recorded first on the basis of the nymphal characters by Yoon and

Aw (1985), and the adults and eggs of the same species were reported by Cho (1991). And Kim et al. (1998) added three species *Alloperla joosti*, *A. rostellata*, and *Sweltsa lepnevae* from the adults. The genus *Haploperla* was reported by only female specimens (Kim et al., 1998), and I also collected only five female specimens in 1999, though expecting for male collection. The determination of the species name may be withheld until male specimens are collected because of the ambiguous female characters.

In present paper, *Alloperla mediata* and *Sweltsa illiesi* are reported for the first time in Korea with line drawings of diagnostic characters and keys to the species for adults.

SYSTEMATIC ACCOUNTS

Order Plecoptera Burmeister, 1839

Family Chloroperlidae Okamoto, 1912

Genus *Alloperla* Banks, 1906

¹**Alloperla mediata* (Navas, 1925) (Figs. 1C, D; 3B)

Chloroperla mediata Navas, 1925, p. 210.

Alloperla (*Sweltsa*) *alexanderi* Nelson & Hanson, 1971, p. 425.

Alloperla mediata: Zwick, Levanidova and Zhiltzova, 1971, p. 855.

Material examined. South Korean specimens: 2♂♂, 3♀♀, Gapyunggun, Myungjisan (Mt.), 16 Jul. 2001 (S.A. Ham); 1♀, Gapyunggun, Myungjisan (Mt.), 18 Jul. 1999 (T. Shi-

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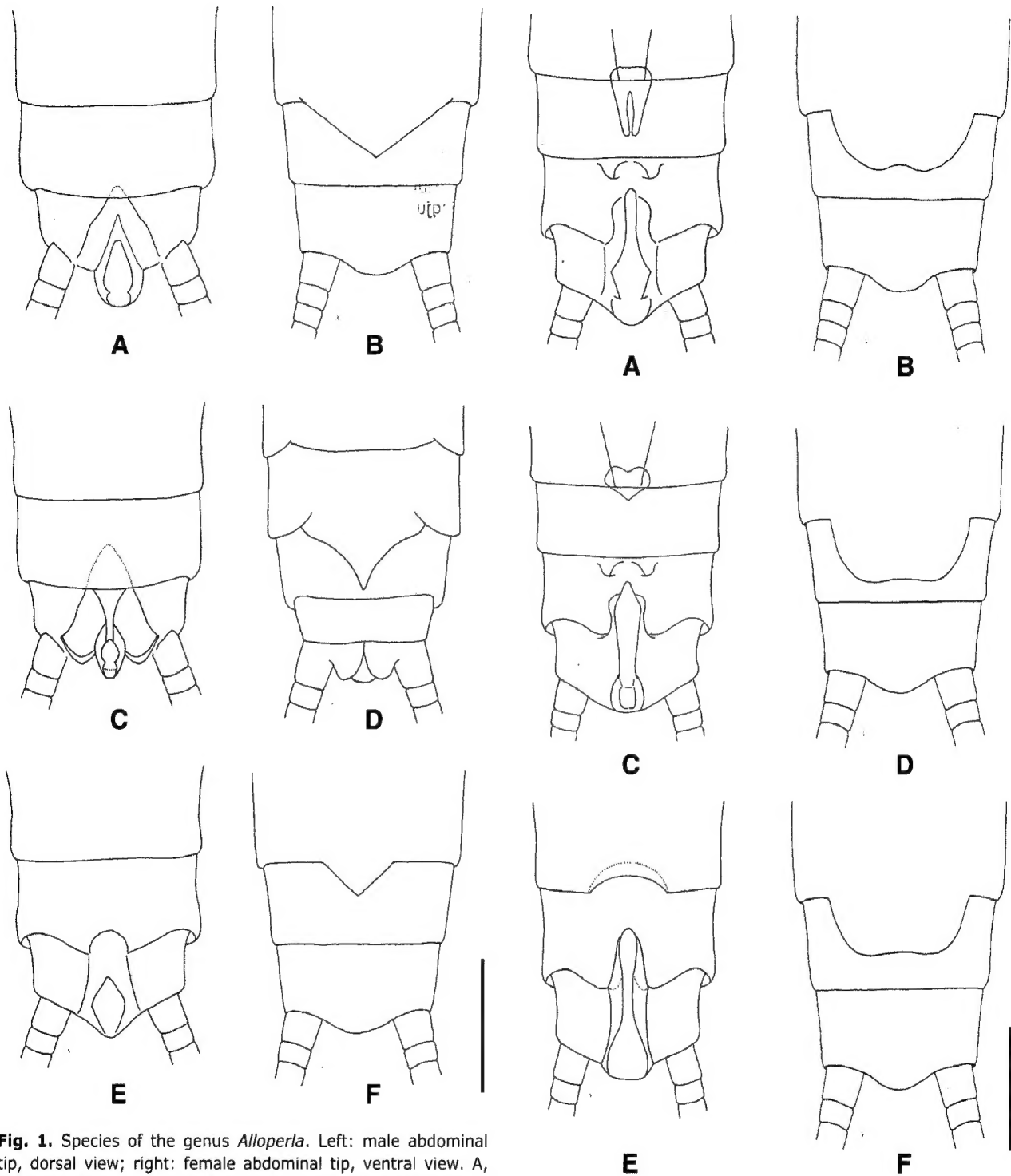


Fig. 1. Species of the genus *Alloperla*. Left: male abdominal tip, dorsal view; right: female abdominal tip, ventral view. A, B, *A. joosti*; C, D, *A. mediata*; E, F, *A. rostellata*. Scale bar=1 mm.

Fig. 2. Species of the genus *Sweltsa*. Left: male abdominal tip, dorsal view; right: female abdominal tip, ventral view. A, B, *S. illiesi*; C, D, *S. lepnevae*; E, F, *S. nikkoensis*. Scale bar=1 mm.

mizu). North Korean specimens: 1♂, 1♀, Jangbaek-pokpo (waterfall), Baekdusan (Mt.), 7 Jul. 2001 (B.W. Kim).

Description. *Male.* Body length 9.0 mm and antenna 6.1 mm. Right forewing 16.5 mm and right hindwing 8.5 mm. Hindwing longer than forewing. Wings pale brown, easy to tear, 2A and 3A fused and then forked in forewing. Anal veins of

hindwing not forked. Head with three ocelli without any markings. Antennae dark brown excepting basement. Prothorax with median dark brown stripe, and meso- and metathorax with grooves and pigmented irregularly. Abdominal

lateral stripes on 1st-2nd segments. Abdominal longitudinal stripe on 1st-8th segments. Sometimes 4th-8th segmental pigmentation incomplete and 8th stripe faded away (Fig. 3B). Each abdominal segment with two dots on the stripe. 10th segment of abdomen grooved medially and deeply, and median part membranous, but both sides sclerotized. Epiproct small relatively, its stalk embedded in the groove, dark brown, and sclerotized strongly (Fig. 1C). Cerci 14 segments, posterior setae on each segment longer than others, and cercal tip dark brown.

Female. Body length 12.0 mm and antenna 9.8 mm. Right forewing 11.5 mm and right hindwing 9.6 mm. Cerci 3.3 mm. Female characters similar to male. Abdominal longitudinal stripe on 1st-8th segments (Fig. 3B). Subgenital plate sharpened upward triangle, reaching nearly to 9th segment end, sclerotized strongly on the median, and frustrated transversely (Fig. 1D). Cerci 14 segments.

Remarks. This species is similar to *Alloperla joosti* (see Zwick, 1971b) in the body coloration, patterns, and the shape of epiproct, but this can be easily distinguished by the smaller epiproct and the presence of a median sclerite under epiproct in male. And female subgenital plate modified to form sharpened upward triangle contrary to the unmodified triangle in *A. joosti*.

Distribution. South Korea, North Korea, Far East Russia, Japan.

Genus *Sweltsa* Ricker, 1943

¹**Sweltsa illiesi* Zhiltzova & Levanidova, 1978
(Figs. 2A, B; 3D)

Sweltsa illiesi Zhiltzova & Levanidova, 1978, p18.

Material examined. South Korean specimens: 4 ♀ ♀, 1.5 km before Seseokpyungjeon, Jirisan (Mt.), 1 Jun. 2002 (S.A. Ham); 1 ♀, 1 km before Seseokpyungjeon, Jirisan (Mt.), 1 Jun. 2002 (S.A. Ham); 1 ♀, Sangwongol, Chiaksan (Mt.), 15 Jun. 2002 (S.A. Ham); 1 ♂, 1 ♀, Mujugucheondong valley, Deokyusan (Mt.), 13 Apr. 2001 (S.A. Ham); 1 ♂, 1 ♀, Gapyungcheon, Myungjisan (Mt.), 18 May 2001 (S.J. Kwon); 1 ♀, Sangwonsa valley, Chiaksan (Mt.), 1 Jun. 2001 (S.A. Ham); 6 ♂ ♂, 2 ♀ ♀, Sangwonsa valley, Chiaksan (Mt.), 11 May 2001 (S.J. Kwon); 10 ♂ ♂, 2 ♀ ♀, Sangwonsa valley, Chiaksan (Mt.), 11 May 2001 (S.A. Ham); 2 ♀ ♀, Sangwonsa valley, Chiaksan (Mt.), 25 May 2000 (S.A. Ham); 5 ♀ ♀, Sangwonsa valley, Chiaksan (Mt.), 9 Jun. 2000 (S.A. Ham); 1 ♂, Osaekyaksu, Seoraksan (Mt.), 16 Jun. 2000 (S.A. Ham); 24 ♀ ♀, Sangwonsa valley, Chiaksan (Mt.), 11 Jun. 1999 (T. Shimizu); 6 ♀ ♀, Sangwonsa valley, Chiaksan (Mt.), 15 Jun. 1999 (S.A. Ham); 1 ♂, 2 ♀ ♀, Pyungchang-

gun, Baekseoksan (Mt.), 17 Jun. 1997 (J.S. Kim); 1 ♂, Sanjang valley, Mudeungsan (Mt.), 12 May 1994 (S.A. Ham); 1 ♀, Nojeokpokpo (waterfall), Misiryung, Seoraksan (Mt.), 15 Jun. 1994 (J.S. Kim); 24 ♀ ♀, Woljeongsa valley, Odaesan (Mt.), 16 Jun. 1994 (J.S. Kim); 2 ♀ ♀, Sogeumgang, Odaesan (Mt.), 17 Jun. 1994 (J.S. Kim); 21 ♀ ♀, Guryongsa valley, Chiaksan (Mt.), 17 Jun. 1994 (J.S. Kim). North Korean specimens: 1 ♂, 1 ♀, Jangbaek-pokpo (waterfall), Baekdusan (Mt.), 7 Jul. 2001 (B.W. Kim).

Description. Male. Body length 8.9 mm and antenna 4.2 mm. Antennae dark brown excepting basement. Right forewing 13.0 mm and right hindwing 8.6 mm. Head with three ocelli, pigmentation between front ocellus and two hind ocelli like upward V-shape (Fig. 3D). Prothoracic border pigmented and the surface with pattern. Forewing longer than hindwing. Wings hyaline, and weak to tear. Hindwing with three anal veins and folded along 1A vein. Abdominal side stripes on 1st-2nd segments distinctively, and 3rd and 4th side stripes small and obscure. Abdominal longitudinal stripe on 1st-7th segments (Fig. 3D). 10th tergum concaved to form deep groove, sclerite within the groove. Epiproct embedded in the groove and epiproctal tip sometimes inserted 9th segment (Fig. 2A). To tip from the middle of male epiproct modified into a slender rod, sclerotized strongly, dark brown except for brown basement. Abdominal sternum unmodified. Cerci 7 segments without long setae.

Female. Female characters similar to male. Body length 8.6 mm and antenna 4.3 mm. Right forewing 14.0 mm and right hindwing 9.3 mm. Head and prothorax pigmented darker than male. Abdominal 8th segment modified to form subgenital plate. Subgenital plate round, reaching to a half of 9th, sclerotized weakly, pale brown color and median not round (Fig. 2B).

Remarks. This species is similar to *Sweltsa assam* (see Zwick, 1971a) in the shape of epiproct but this can be easily distinguished by the presence of a pair of ridges on tergum 9 (absence in *S. assam*) in male and the different head pattern (upward V-shape in *S. illiesi*, but dark broad pattern on the center of head in *S. assam*) in adults.

Distribution. South Korea, North Korea, Far East Russia.

Key to the species of Korean Chloroperlidae for males

1. Male epiproct reaching about middle or tip of tergum 9 ...
..... Genus *Sweltsa* 4
- Male epiproct not reaching tergum 9
..... Genus *Alloperla* 2
2. Male epiproctal notch absent on the side (Figs. 1E, 3C) ...
..... *A. rostellata*
- Male epiproctal notch present on each side of about 1/3

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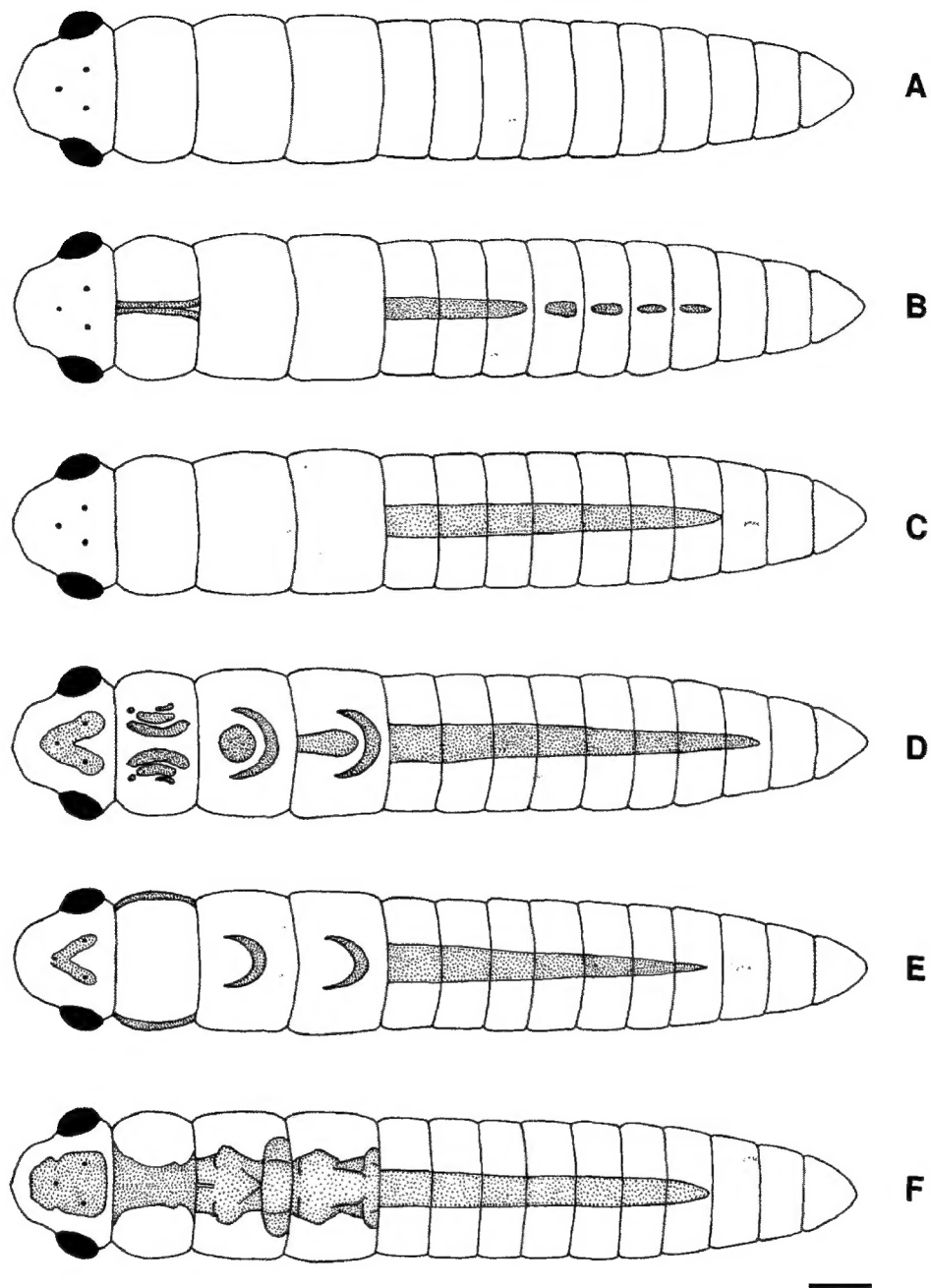


Fig. 3. Entire body of Korean Chloroperlid species (appendages omitted), dorsal view. A, *A. joosti*; B, *A. mediata*; C, *A. rostellata*; D, *S. illiesi*; E, *S. lepnevae*; F, *S. nikkoensis*. Scale bar=1 mm.

- point 3
- 3. Median sclerite under male epiproct absent (Figs. 1A, 3A) *A. joosti*
- Median sclerite under male epiproct long and narrow (Figs. 1C, 3B) *A. mediata*
- 4. Tergum 9 with a pair of ridges 5
- Tergum 9 without any ridge (Figs. 2E, 3F) *S. nikkoensis*
- 5. To tip from the middle of male epiproct modified into a

- slender rod (Figs. 2A, 3D) *S. illiesi*
- Tip of male epiproct modified into triangle (Figs. 2C, 3E) *S. lepnevae*

Key to the species of Korean Chloroperlidae for females

- 1. Female subgenital plate triangular Genus *Alloperla* 2
- Female subgenital plate round and notched Genus *Sweltsa* 4

2. Female subgenital plate about 3/4 the width of sternum 8 at base 3
 - Female subgenital plate about 1/3 the width of sternum 8 at base (Fig. 1F) *A. rostellata*
3. Female subgenital plate unmodified triangle (Fig. 1B) *A. joosti*
 - Female subgenital plate sharpened upward triangle and reaching nearly to 9th segment end (Fig. 1D) *A. mediata*
4. Female subgenital plate reaching beyond the middle of sternum 9 (Fig. 2D) *S. lepnevae*
 - Female subgenital plate reaching at most middle of sternum 9 5
5. Female subgenital plate notched heavily (Fig. 2B) *S. illiesi*
 - Female subgenital plate round or notched slightly (Fig. 2F) *S. nikkoensis*

ACKNOWLEDGEMENTS

I appreciate Dr. B.W. Kim donating the specimens from North Korea. This work was supported by grant from the Fauna and Flora of Korea (2007-2008).

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Received June 4, 2008
Accepted July 10, 2008